

## Habitat in a Bottle

### Purpose

To explore how different combinations of environmental factors affect a habitat and seeds that are planted there.

### Process Skills

Observe, make a model, form a hypothesis, measure, collect data, interpret data, identify and control variables, draw conclusions

### Background

A **habitat** is a natural place in which plants and animals live. Different environmental conditions make each habitat a good home for certain living things, but not a good home for other living things.

A habitat's **latitude**—or position north or south of the equator—determines how much light a habitat receives from the Sun during different times of the year.

A habitat's **elevation** affects its temperature. Higher elevations usually have cooler temperatures than lower elevations. The **climate** in a habitat is the pattern of weather in that place over a long period of time. Each living thing has a certain type of climate in which it grows or survives best. The land and water features in a habitat are two more important factors in determining what can live there. Some places may be rocky and dry, while others have rich soil and are covered with lakes and rivers.

### Materials

- ☐ data sheet (1 per group)
- ☐ Habitat Cards (4 per group)
- ☐ clear, plastic 2-liter soda bottle with top half cut off
- ☐ potting soil
- ☐ local dirt
- ☐ sand
- ☐ ruler
- ☐ fast-growing seeds (e.g., mustard, grass, beans)
- ☐ 25-mL graduated cylinder or other liquid measure
- ☐ water
- ☐ plastic cling wrap
- ☐ masking tape
- ☐ index card

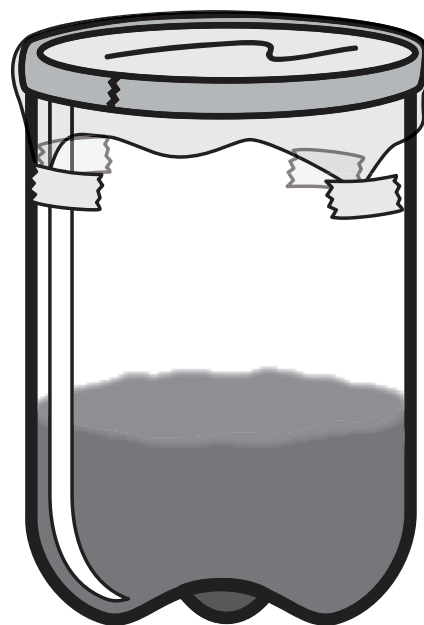
### Optional Materials

- ☐ lamp
- ☐ black construction paper
- ☐ 3 ice cubes  
(available each day)
- ☐ small zipper bag for ice
- ☐ thick cloth (e.g., towel, sweatshirt)
- ☐ thermometer

Plants and animals are also important parts of a habitat. In this activity, you will build a model of a habitat inside a bottle. Then you will explore how different combinations of environmental factors will affect one type of seed that is trying to grow inside the habitat.

**Time** – Planning and assembly, 45 minutes  
Observation, 10 minutes a day for  
2–3 weeks

**Grouping** – Pairs or small groups



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## Procedure

### Preparation

1. (Teacher only) Prepare each soda bottle by cutting off the top half, then lining the rim with masking tape to cover the sharp edge.
2. Cut out the habitat cards and place each category face down in its own shuffled pile.

### Preparing a Habitat in a Bottle

1. Each group should draw one habitat card from each pile. On the data sheet, use the information from the four

cards you drew to record how your habitat will be set up.

[**Note:** If your group is asked to create more than one habitat, draw a new card from each pile and use a separate data sheet for each additional bottle.]

2. As a group, discuss which materials you will need for your habitat, and where the bottle will need to be placed. Gather the materials you need to build your habitat, based on the cards you drew.

3. Add the local dirt, potting soil, or sand to fill the bottom 5 cm (2 in.) of the bottle.
4. Spread the seeds on the surface of the soil, dirt, or sand. Only use the number of seeds that were written on the Plant Life card. Then cover the seeds by adding 2.5 cm (1 in.) more dirt, soil, or sand.
5. If you have to do anything special to your bottle, such as covering it with black paper or wrapping it in cloth, do so now. If you have to add ice cubes, place three cubes in a sealed bag and set it on top of the soil.  
**TIP:** Plant the seeds on the opposite side of the soil from the bag of ice, so the bag does not prevent the seeds from growing.
6. Measure the correct daily volume of water for your habitat, then pour it into your habitat. Spread the water evenly around the whole surface of the dirt, soil, or sand.
7. Cut a square piece of plastic cling wrap that will cover the opening of your habitat. Tape it down with masking tape on the four corners.
8. Write your names at the top of an index card, and then record the conditions of your habitat on the card. Tape this card to the side of the bottle.
9. Set your bottle in a location based on information from the cards. For example, if your cards direct you to keep the habitat warm, but with little light, you should cover most of it in black construction paper and set it in a warm place or wrap it in warm cloth.
10. As a group, discuss why you think the seeds will or will not grow well, based on the conditions in the bottle. Then make a hypothesis about how well the seeds will grow, and why. Record your group's hypothesis on the data sheet.

## Observing the Habitat

1. Each day, care for your habitat according to the conditions that were listed on your habitat cards. Peel back the plastic cling wrap to add water, and then reattach it with tape. Always keep your habitat in its proper location with the same conditions as it had on the first day.
2. Write the date on the first empty row of your data sheet. Record observations on that row about how many seeds have sprouted, if any, and how much the plants have grown. If any seeds have sprouted, use a ruler to measure the height (above the soil) of the tallest one.
3. Record any other observations you notice about the bottle habitat. For example, if there is a change in color or odor,



if water is pooling at the bottom, or if the plants look different from the previous day, record this in the last column of your data sheet. If it seems exactly the same as the previous day, write “unchanged” in the space.

4. Continue observing the habitat each school day until your teacher has decided it is time to end the activity. Share your results with the class, so everyone can judge which habitat is the best for this type of seed.

Name \_\_\_\_\_ Date \_\_\_\_\_

**Habitat Facts:**

Latitude:

Climate:

Soil Type:

Plant Life:

**Hypothesis:****Collect Data**

Date	Number of seeds sprouted	Height of tallest seedling	Description of habitat

Name \_\_\_\_\_ Date \_\_\_\_\_

### Analyze Data

1. How many days did it take for your habitat to produce its first seedlings?
2. How many seeds sprouted, and how high did the tallest seedling in your habitat grow? If none sprouted, why do you think this was so?
3. Of all the bottle habitats the class created, in which conditions did this type of seed grow best?
4. If you were to do this activity again, how would you change the conditions in your habitat to make the seeds grow better? Why?
5. Can you be sure which environmental factor caused your seeds to grow well or not to grow well? If so, explain how you could tell. If not, explain how you would have set up the activity to be sure which factor made the biggest difference.

### Draw Conclusions

1. Do you know of a real habitat on Earth that has similar conditions to those in your bottle habitat? If you know of one, what is this habitat called and what kinds of plants and animals live there? If you don't think there is one, why do you suppose such a habitat does not exist?
2. How might the results have been different if you had been given a different type of seed?
3. Did this activity prove that there are certain conditions in which no living things could survive? Explain why or why not.



Habitats/Environment

Latitude

## Near Equator

Keep the bottle  
in sunlight or under  
a lamp during all  
school hours.

 **Science a-z.com** HABITAT CARD

Habitats/Environment

Latitude

## Near North or South Pole

Cover most of the bottle  
with black construction  
paper so only a little  
light gets in.

 **Science a-z.com** HABITAT CARD



Habitats/Environment

Latitude

## Middle Latitude

Keep the bottle  
in normal classroom  
lighting conditions.

 **Science a-z.com** HABITAT CARD

Habitats/Environment

Latitude

## Middle Latitude

Keep the bottle  
in normal classroom  
lighting conditions.

 **Science a-z.com** HABITAT CARD



Habitats/Environment

Latitude

## Middle Latitude

Keep the bottle  
in normal classroom  
lighting conditions.

 **Science a-z.com** HABITAT CARD

Habitats/Environment

Latitude

## Middle Latitude

Keep the bottle  
in normal classroom  
lighting conditions.

 **Science a-z.com** HABITAT CARD



Habitats/Environment

Climate

## Hot and Dry

Place the bottle in the warmest spot in the classroom or wrap it in thick cloth to insulate it. Add 10 mL of water each day.

 **Science a-z.com** HABITAT CARD

Habitats/Environment

Climate

## Hot and Rainy

Place the bottle in the warmest spot in the classroom or wrap it in thick cloth to insulate it. Add 50 mL of water each day.

 **Science a-z.com** HABITAT CARD



Habitats/Environment

Climate

## Mild and Dry

Place the bottle at room temperature. Add 10 mL of water each day.

 **Science a-z.com** HABITAT CARD

Habitats/Environment

Climate

## Mild and Rainy

Place the bottle at room temperature. Add 50 mL of water each day.

 **Science a-z.com** HABITAT CARD



Habitats/Environment

Climate

## Cold and Dry

Seal three ice cubes in a bag and place it inside the bottle each day. Add 10 mL of water each day.

 **Science a-z.com** HABITAT CARD

Habitats/Environment

Climate

## Cold and Rainy

Seal three ice cubes in a bag and place it inside the bottle each day. Add 50 mL of water each day.

 **Science a-z.com** HABITAT CARD





Habitats/Environment

Soil Type

## Dirt

Fill the bottom of the  
bottle with local dirt.

 **Science a-z.com** HABITAT CARD

Habitats/Environment

Soil Type

## Dirt

Fill the bottom of the  
bottle with local dirt.

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Habitats/Environment

Soil Type

## Soil

Fill the bottom of the  
bottle with potting soil.

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Habitats/Environment

Soil Type

## Soil

Fill the bottom of the  
bottle with potting soil.

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Habitats/Environment

Soil Type

## Sand

Fill the bottom of the  
bottle with sand.

 **Science a-z.com** HABITAT CARD

Habitats/Environment

Soil Type

## Sand

Fill the bottom of the  
bottle with sand.

 **Science a-z.com** HABITAT CARD



Habitats/Environment

Plant Life

## Few Plants

Plant 4 seeds  
in the soil.

 **Science a-z.com** HABITAT CARD

Habitats/Environment

Plant Life

## Few Plants

Plant 4 seeds  
in the soil.

 **Science a-z.com** HABITAT CARD



Habitats/Environment

Plant Life

## Some Plants

Plant 9 seeds  
in the soil.

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Habitats/Environment

Plant Life

## Some Plants

Plant 9 seeds  
in the soil.

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Habitats/Environment

Plant Life

## Many Plants

Plant 16 seeds  
in the soil.

 **Science a-z.com** HABITAT CARD

Habitats/Environment

Plant Life

## Many Plants

Plant 16 seeds  
in the soil.

 **Science a-z.com** HABITAT CARD

# Habitat in a Bottle

## TEACHING TIPS

*This process activity will help students understand that the world is made up of many different kinds of habitats. Each one has a distinct blend of environmental factors, including latitude, elevation, climate, land features, water features, plant life, and animal life. The organisms that live in each habitat are specially adapted to live there and are interdependent. Over time, habitats can change due to natural forces and human actions. When a habitat changes, the organisms that live within it must either adapt or move out of it in order to survive. Human activity can have considerable effects on natural habitats. Taking action to protect a habitat from harmful changes could provide a healthy and sustainable environment for many species in the future.*

## SET-UP AND PROCEDURES

- If students will draw cards, having extra copies available may help the selection process happen more quickly. If one group's habitat will be identical to that of another group, ask one of the groups to draw a new habitat card. To ensure a wide variety of conditions in the habitats, you may want to assign habitat cards to groups, rather than having students draw cards from each pile.
- Some groups may wind up with combinations of environmental conditions that are not conducive to plant growth. If materials allow, you may want to allow each group to make more than one habitat in a bottle to ensure greater success.
- To simulate a cold environment, rather than having students place a bag of ice in the growing area, you might have students stand the bottle up in a tray and surround it with ice cubes each day. Putting the bottle in a refrigerator would make it cold, but it would also affect the amount of light the plants received.
- Provide time each day for students to observe their habitats, to discuss the results with their group, and to update their data sheets.
- Conclude the activity once a majority of the groups have had some seeds sprout and grow to a measurable height.
- If thermometers are available, you can have students measure the temperature inside their bottle habitats, and compare results with those of other groups.

## SAFETY

Carefully use a utility knife or another sharp tool to precut the bottles. Cover the rim with masking tape to protect students' fingers.

**MATERIALS**

- Several days or weeks prior to starting the activity, ask students to bring in clean, clear, two-liter soda bottles.
- One bag of potting soil should provide enough soil for all groups that need it. Students can likely supply the local dirt and the sand.
- Select a type of seed that is known to grow quickly, such as grass, sunflower, mustard, bean, or radish. Consult a garden center or search online for more good options.
- You can adjust the information on the habitat cards before making copies for student use, such as increasing water volumes, adjusting seed counts, or adding other soil options.
- If observations last more than ten days, provide extra data sheets.

**EXTENSIONS AND VARIATIONS**

- *Inquiry Science*: Students can retry the exploration with some variables adjusted, such as uncovering the bottle or sealing the bottle inside large zipper bags. They may suggest different soil types, including mixtures. Students might also try growing the seeds without soil, by planting the seeds in wet paper towels or in water.
- *Variation*: Use wider containers and plant several seed types in rows, to see how each type responds to the environmental conditions.
- *Home Connection*: Encourage students to try the exploration at home, choosing their own materials and environmental factors. Have students keep a science journal to track their results and to report to the class.
- *Math*: Challenge students to calculate how many unique combinations were possible based on the habitat cards. *Solution*:  $3 \text{ latitudes} \times 6 \text{ climates} \times 3 \text{ soil types} \times 3 \text{ plant options} = 162 \text{ combinations}$ .
- *Research*: See Using the Internet in the *Unit Guide* for suggested websites to extend the learning.

**ANSWER KEY**

*Information from the habitat cards should be written in the appropriate spaces.*

*Hypotheses will vary, but should describe how well students think their seeds will grow, and why, based on environmental factors in their bottle habitat and based on what they already know about what plants need.*

*Data on the table will vary. Appropriate units should accompany heights. Descriptions may include changes in color or odor, the condition of the plants, or other observations.*

EXPLORATION

Habitats/Environment—Habitat in a Bottle Data Sheet

Name \_\_\_\_\_ Date \_\_\_\_\_

**Habitat Facts:**

Latitude:

Climate:

Soil Type:

Plant Life:

**Hypothesis:****Collect Data**

Date	Number of seeds sprouted	Height of tallest seedling	Description of habitat

## ANSWER KEY AND EXPLANATIONS

### Analyze Data

1. How many days did it take for your habitat to produce its first seedlings?

*Results will vary.*

2. How many seeds sprouted, and how high did the tallest seedling in your habitat grow?  
If none sprouted, why do you think this was so?

*Results will vary. Appropriate units should accompany the height. If no seeds sprouted, students may conclude this was due to the soil type or temperature being a bad match for the seed type, too much or too little water or light being used, or too many seeds competing for the same resources.*

3. Of all the bottle habitats the class created, in which conditions did this type of seed grow best?

*Results will vary. Encourage all groups to report their results to the class.*

4. If you were to do this activity again, how would you change the conditions in your habitat to make the seeds grow better? Why?

*Students should consider the conditions in their bottle habitat, and suggest which one(s) they would change to improve their seeds' chances of growing better, along with a reason why. For example, if the plants wilted in the heat, students might suggest trying a cooler environment.*

5. Can you be sure which environmental factor caused your seeds to grow well or not to grow well? If so, explain how you could tell. If not, explain how you would have set up the activity to be sure which factor made the biggest difference.

*In this exploration, many variables were tested at once. To identify the factor that made the biggest difference, one would have to keep all but one of the variables the same.*

### Draw Conclusions

1. Do you know of a real habitat on Earth that has similar conditions to those in your bottle habitat? If you know of one, what is this habitat called and what kinds of plants and animals live there? If you don't think there is one, why do you suppose such a habitat does not exist?

*Many combinations of the factors listed on the cards can be found in real habitats. Encourage students to research real habitats that have similar conditions to those of their bottle. Certain combinations are unlikely in nature, such as Hot and Rainy with Near North or South Pole.*

2. How might the results have been different if you had been given a different type of seed?

*Some seeds may have grown better in hot, dry conditions while others may have required cooler conditions, with rich soil and more water.*

3. Did this activity prove that there are certain conditions in which no living things could survive? Explain why or why not.

*No. It only proved whether this particular type of seed could survive in several different habitats.*